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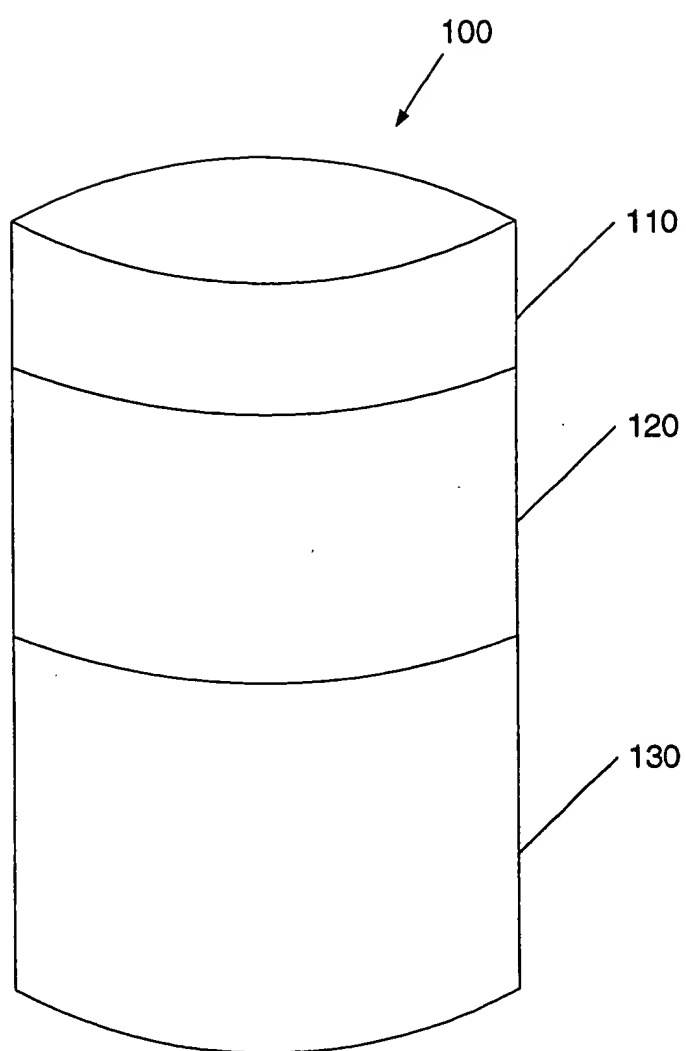


Figure 1

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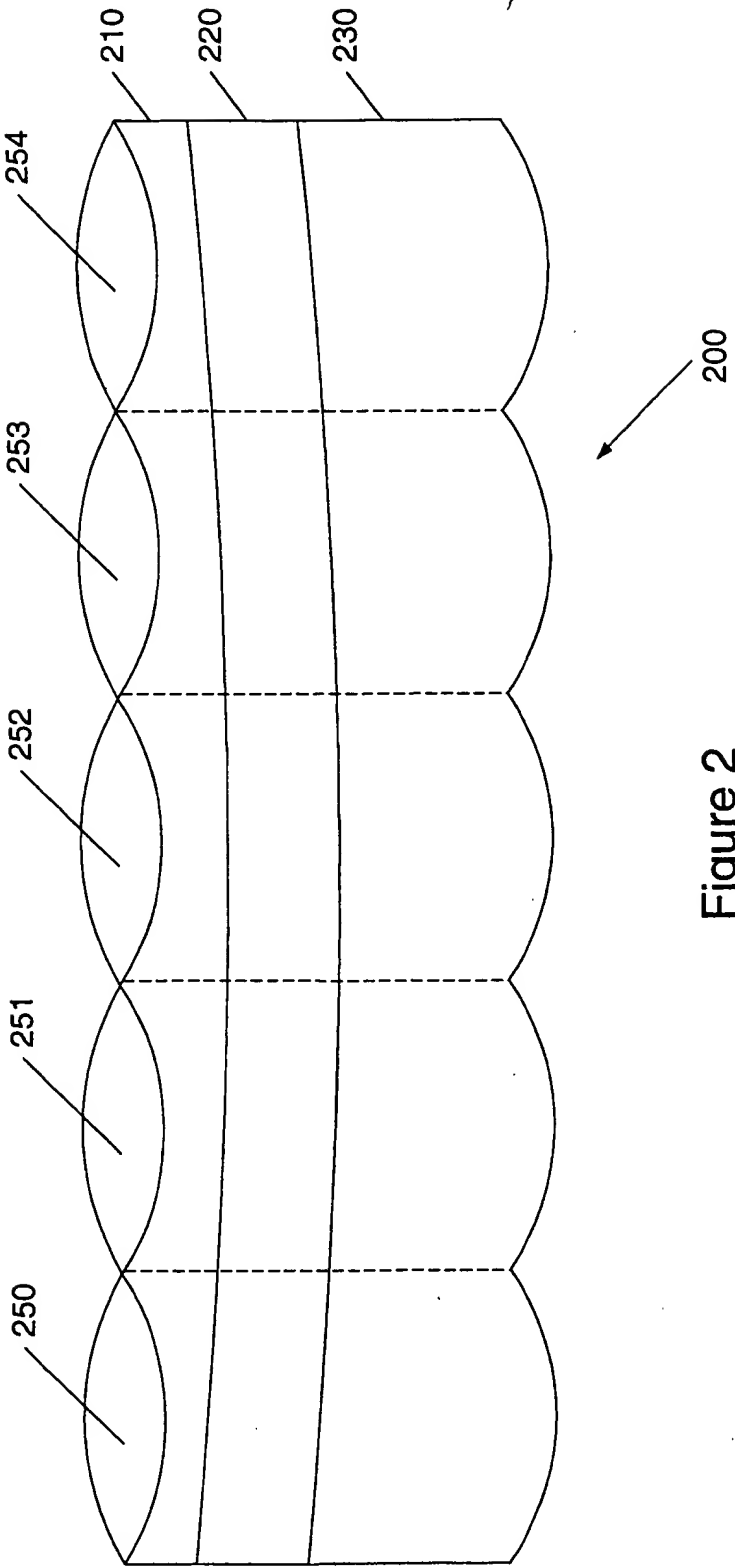
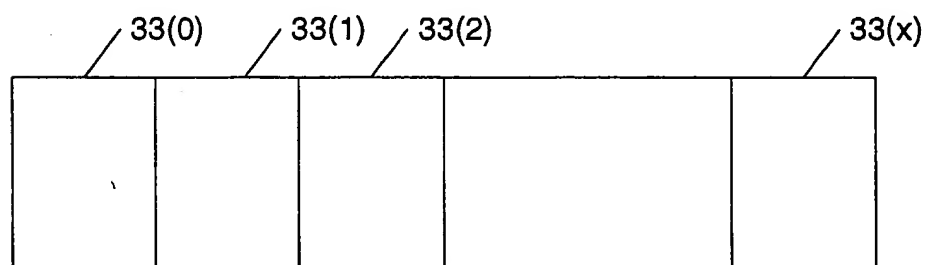


Figure 2

A diagram of a memory array 31, represented as a vertical rectangle divided into five horizontal cells. The cells are labeled on the right side as 31(0), 31(1), 31(2), and 31(x), with a line pointing from each label to its corresponding cell. The fifth cell from the top is unlabeled.

300



31(0)

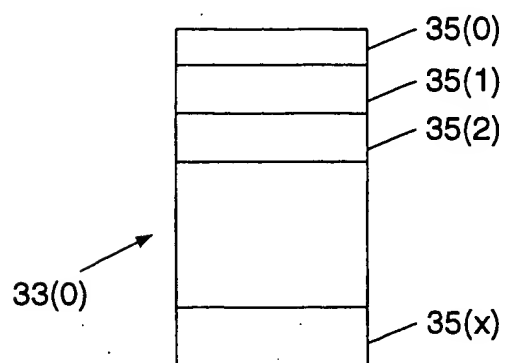


Figure 3c

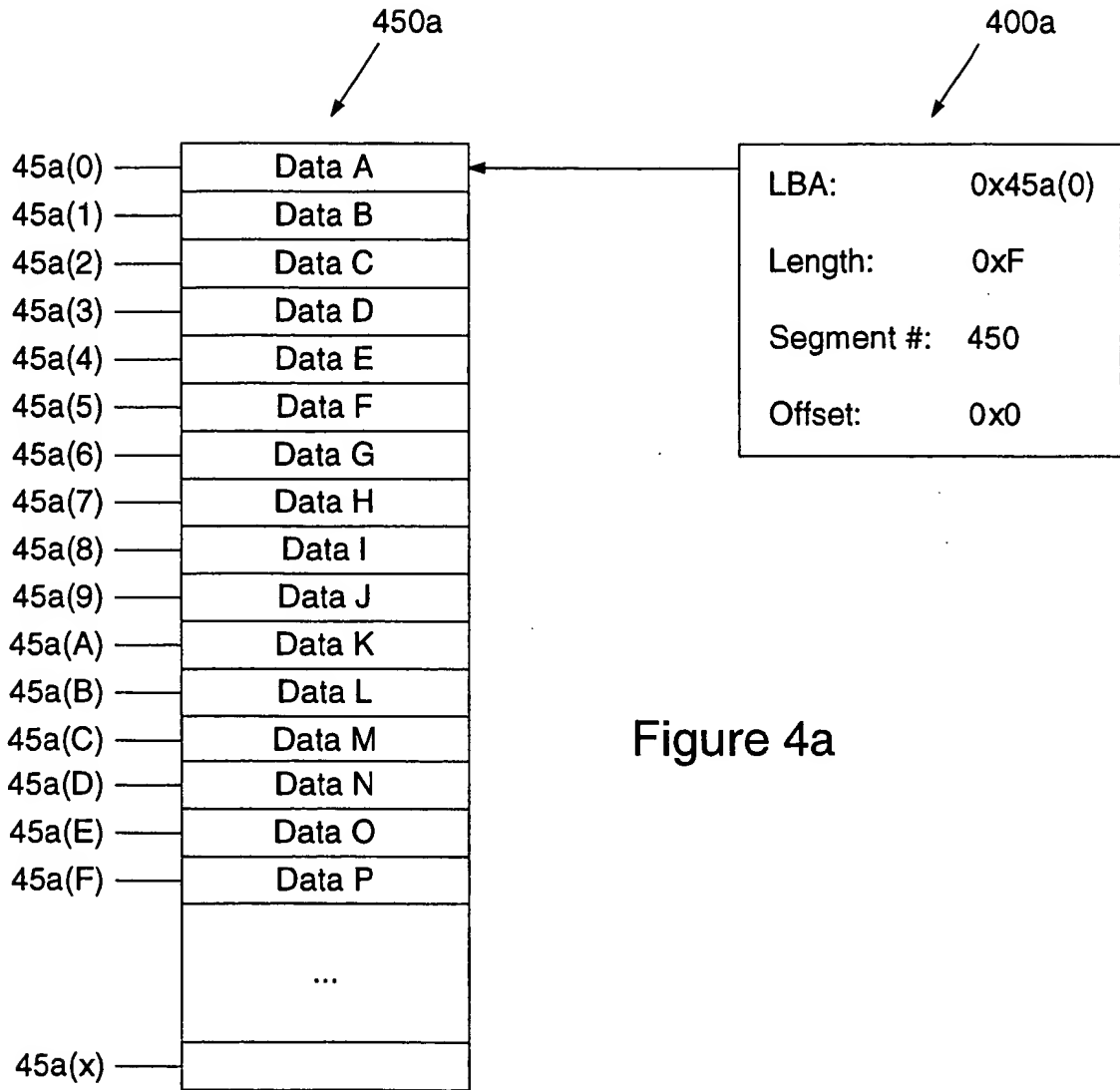


Figure 4a

The diagram illustrates a segmented storage system. It consists of three main data blocks and three corresponding metadata blocks.

Data Block 1 (Top Left): A vertical stack of 17 data blocks labeled Data A through Data P, followed by an ellipsis and a final block. The addresses on the left are 45a'(0) through 45a'(F) and 45a'(x).

Metadata Block 1 (Top Right): A box containing the following information:

- LBA: 0x45a'(0)
- Length: 0x8
- Segment #: 450
- Offset: 0x0

 An arrow labeled 400a'(1) points to this box.

Data Block 2 (Middle Left): A vertical stack of 6 data blocks labeled Data L through Data P, followed by an ellipsis and a final block. The addresses on the left are 45a'(B) through 45a'(F) and 45a'(x).

Metadata Block 2 (Middle Right): A box containing the following information:

- LBA: 0x45a'(A)
- Length: 0x6
- Segment #: 450
- Offset: 0xA

 An arrow labeled 400a'(3) points to this box.

Data Block 3 (Bottom Left): A vertical stack of 3 data blocks labeled Data I', Data J', and an ellipsis, followed by a final block. The addresses on the left are 47b(x+1), 47b(x+2), and 47b(x).

Metadata Block 3 (Bottom Right): A box containing the following information:

- LBA: 0x47b(0)
- Length: 0x2
- Segment #: 470
- Offset: 0x(x+1)

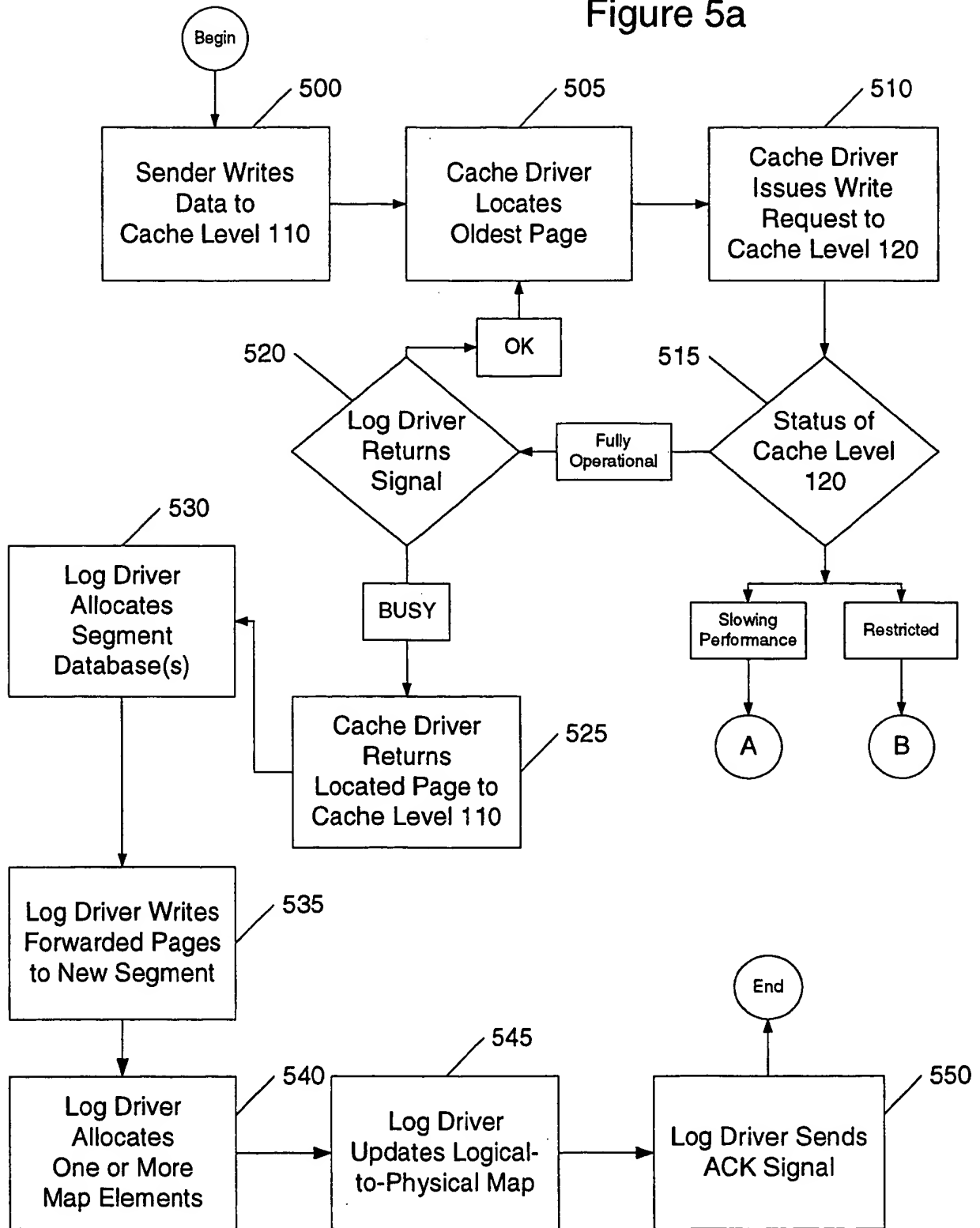
 An arrow labeled 400a'(2) points to this box.

Arrows indicate the mapping from metadata blocks to data blocks:

- Arrow 450a' points from the first metadata box to the first data block.
- Arrow 400a'(1) points from the first metadata box to the first data block.
- Arrow 400a'(3) points from the second metadata box to the second data block.
- Arrow 470b points from the third data block to the third metadata box.
- Arrow 400a'(2) points from the third metadata box to the third data block.

Figure 4b

Figure 5a



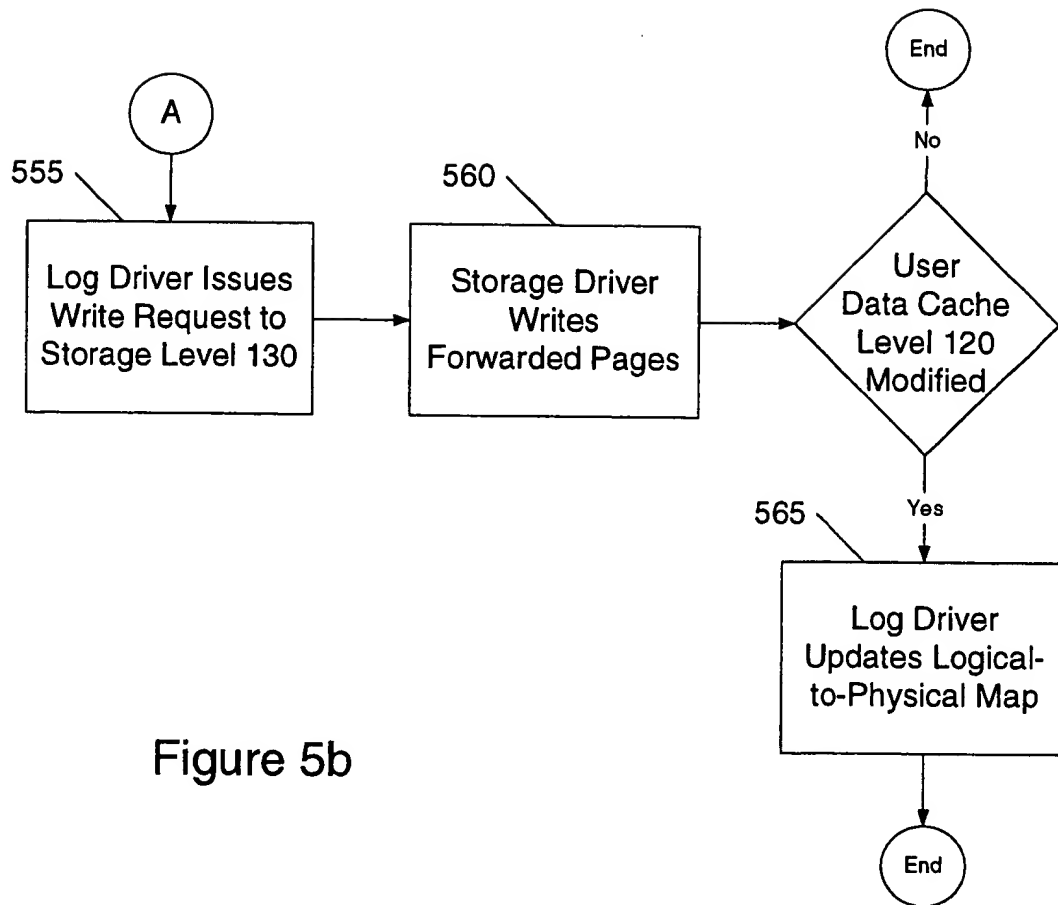
[illegible]

Figure 5b

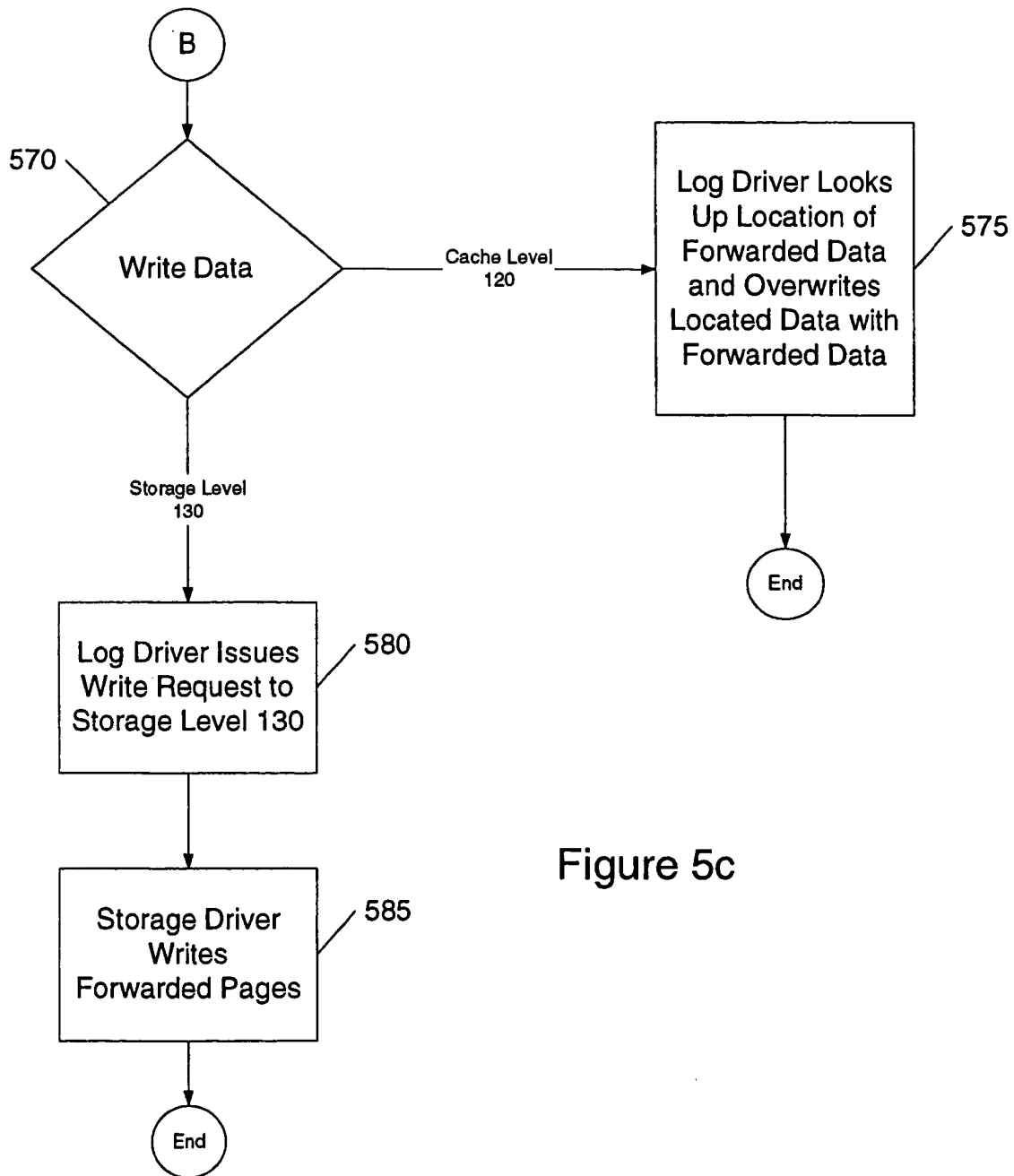
[illegible]

Figure 5c

Figure 6a

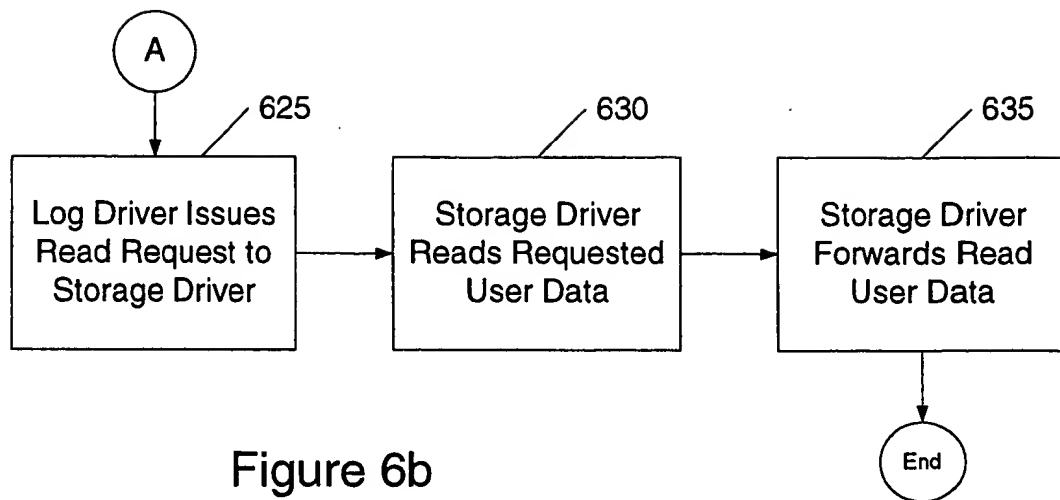


Figure 6b

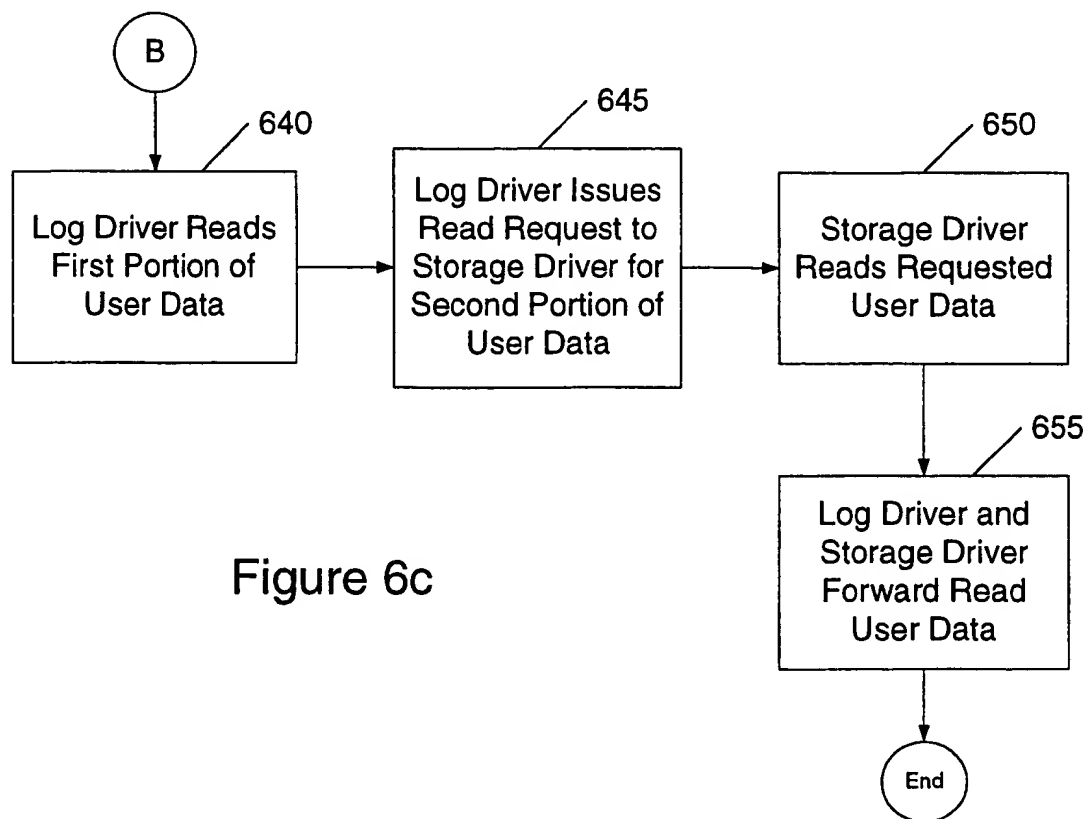


Figure 6c

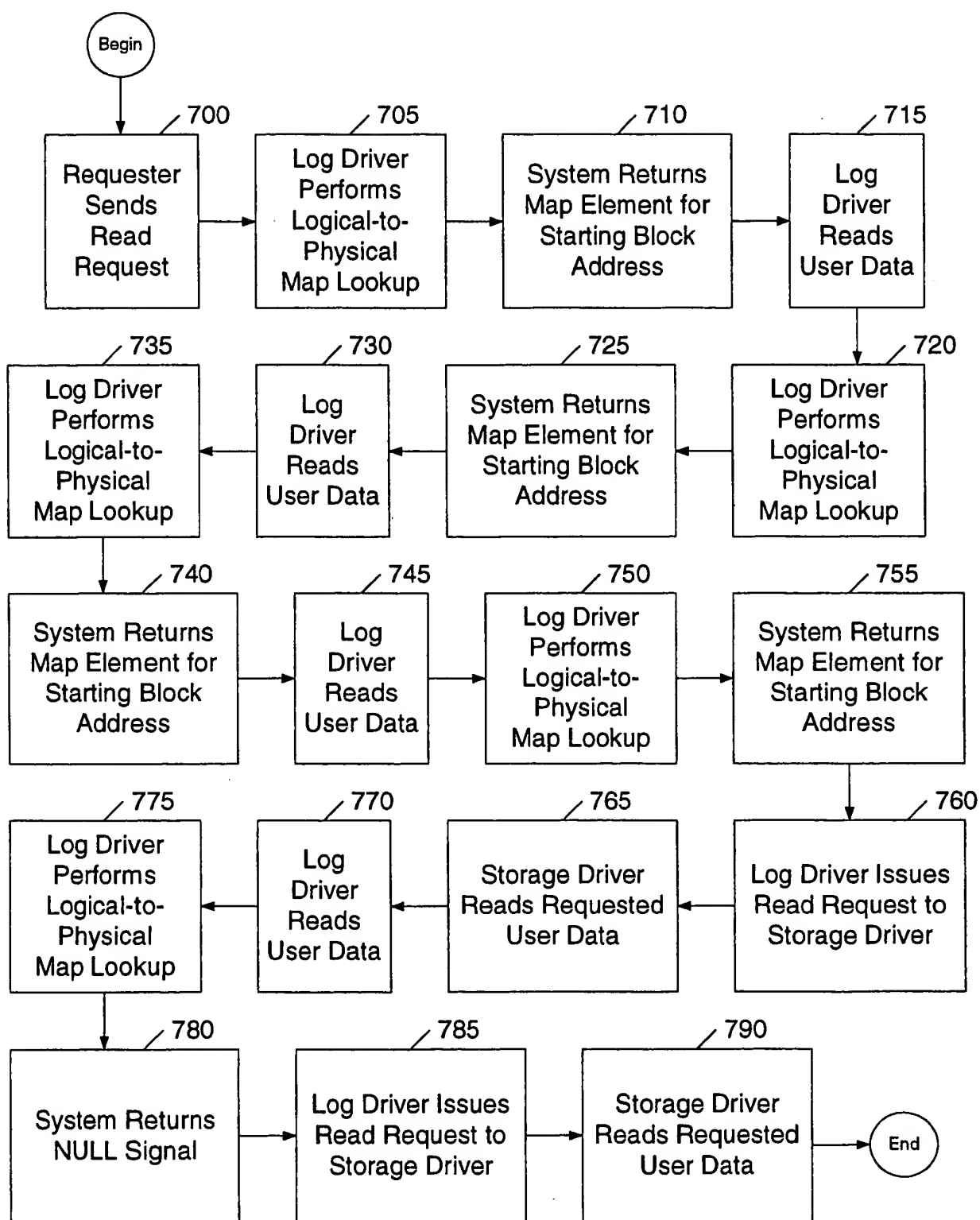


Figure 7

```

graph TD
    Begin((Begin)) --> 800[Log Driver Writes Data to New Segment]
    800 --> 805[System Places Segment Summary for New Segment on Top of Hot List]
    805 --> 810[System Pushes Oldest Segment Summary Down to Cleaning Matrix]
    810 --> 815[System Determines Segment Utilization]
    815 --> 820[System Places Segment Summary at Top of Appropriate Utilization-Bucket]
    820 --> 825[System Traverses Cleaning Matrix]
    825 --> 830{Enough Live Data to Write Full Segment}
    830 -- No --> 825
    830 -- Yes --> 835[System Reads User Data]
    835 --> 840[System Packs Read Live Data Into New Segment]
    840 --> 845[System Updates Map Elements Which Point to Read Live Data]
    845 --> 850[System Releases New Segment and Cleaned Segments]
    850 --> End((End))
  
```

Figure 8

Figure 8

| | Utilization Percent | | | | |
|---|---------------------|-------|-------|-------|--------|
| | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 |
| 0 | 400 | 401 | 402 | | |
| 1 | 300 | 301 | 302 | 303 | |
| 2 | 200 | 201 | | | |
| 3 | 100 | 101 | 102 | | |
| 4 | | | | | |

| | | Utilization Percent | | | | |
|-----|---|---------------------|-------|-------|-------|--------|
| | | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 |
| Age | 0 | 500 | 501 | 502 | | |
| | 1 | 400 | 401 | 402 | | |
| | 2 | 300 | 301 | 302 | 303 | |
| | 3 | 200 | 201 | | | |
| | 4 | 100 | 101 | 102 | | |

| | | Utilization Percent | | | | |
|-----|---|---------------------|---------|-------|-------|--------|
| | | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 |
| Age | 0 | 600 | 601 | 602 | 603 | |
| | 1 | 500 | 501 | 502 | | |
| | 2 | 400 | 401 | 402 | | |
| | 3 | 300 | 301 | 302 | 303 | |
| | 4 | 200+100 | 201+101 | 102 | | |

Figure 10a is a 5x5 grid showing Utilization Percent by Age (0-4) and Utilization Percent (0-20, 20-40, 40-60, 60-80, 80-100). The grid contains numbers 1 through 13, with some cells empty. An arrow points to the grid with the label '1000'.

| | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 |
|---|------|-------|-------|-------|--------|
| 0 | 1 | 5 | 9 | 12 | |
| 1 | 2 | 6 | 10 | 13 | |
| 2 | 3 | 7 | 11 | | |
| 3 | 4 | 8 | | | |
| 4 | | | | | |

Figure 10b is a 5x5 grid showing Utilization Percent by Age (0-4) and Utilization Percent (0-20, 20-40, 40-60, 60-80, 80-100). The grid contains numerical values representing utilization percentages. An arrow points to the grid with the label '1000'.

| | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 |
|---|------|-------|-------|-------|--------|
| 0 | 1 | 3 | 6 | 10 | |
| 1 | 2 | 5 | 9 | 13 | |
| 2 | 4 | 8 | 12 | | |
| 3 | 7 | 11 | | | |
| 4 | | | | | |

| | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 |
|---|------|-------|-------|-------|--------|
| 0 | 1 | 4 | 9 | 12 | |
| 1 | 2 | 5 | 10 | 13 | |
| 2 | 3 | 7 | 11 | | |
| 3 | 6 | 8 | | | |
| 4 | | | | | |

Figure 10c

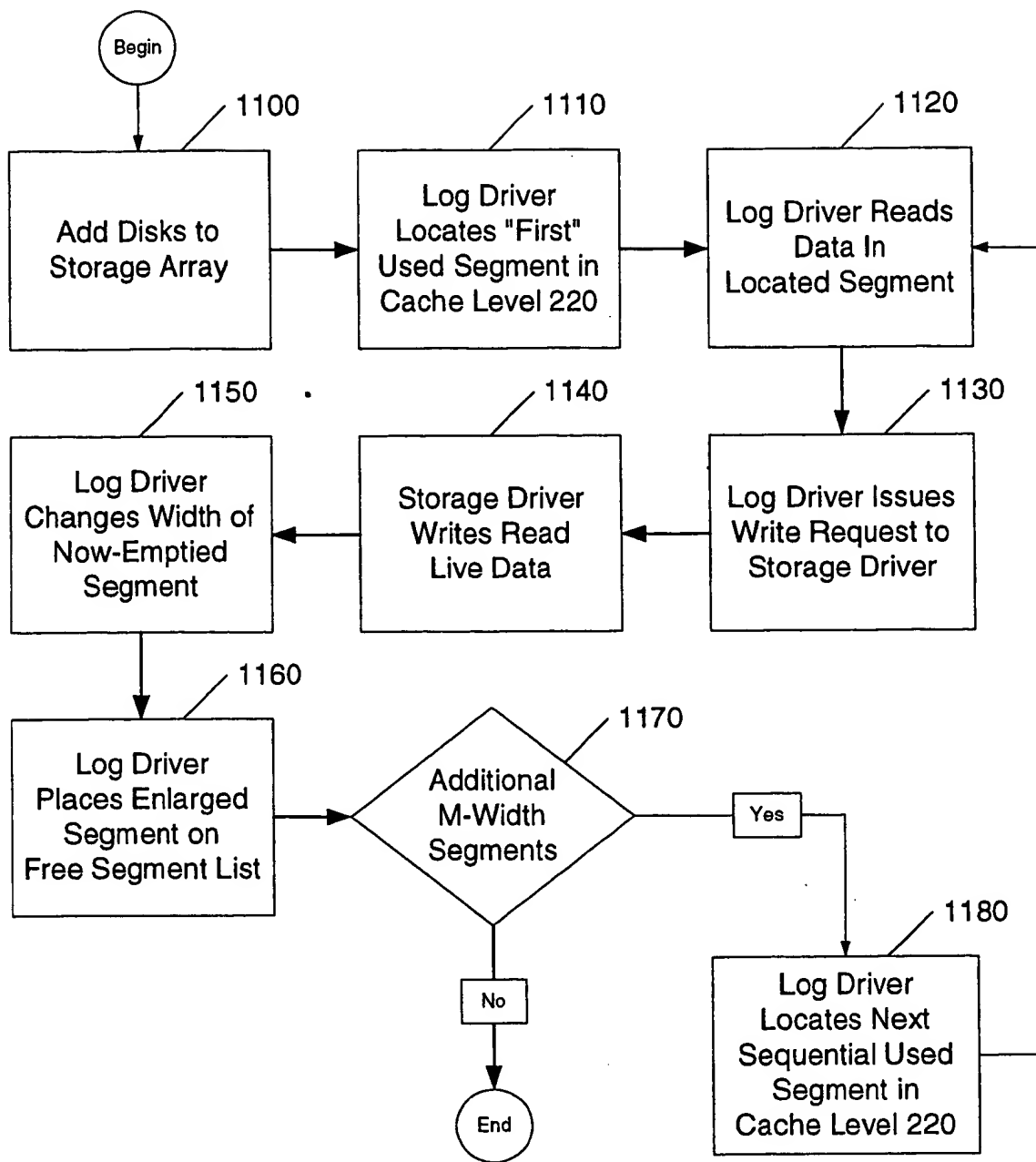


Figure 11

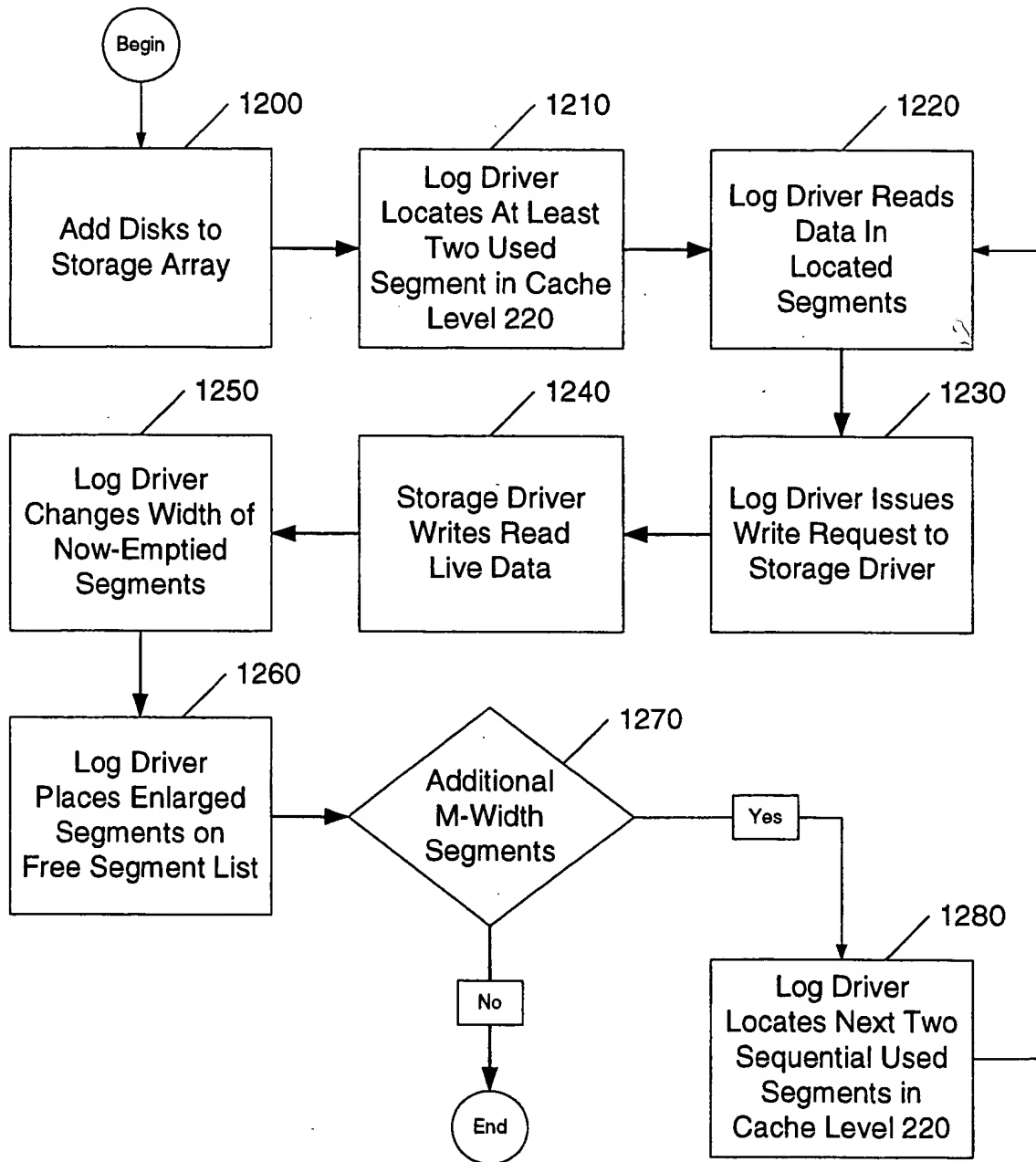


Figure 12